

# **NASA Earth Observations Informing Energy Management Decision Making**

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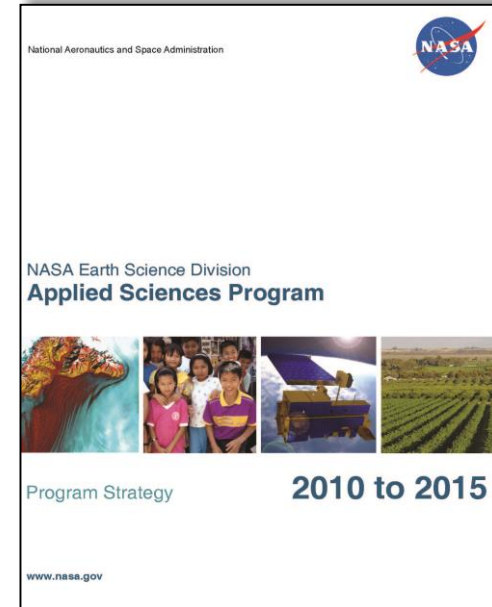
**National Adaptation Forum**  
**May 11, 2017**

# NASA Applied Sciences Program: Lines of Business

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*Discovering and demonstrating innovative and practical uses of Earth observations in organizations' policy, business, and management decisions.*



**<http://AppliedSciences.NASA.gov>**

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## *Applications*

Prove-out, develop, and transition applications ideas for sustained uses of Earth obs. in decision making.

## *Capacity Building*

Build skills and capabilities in US and developing countries to access Earth observations to benefit society.

## *Mission Planning*

Identify applications early in mission lifecycle and integrate end-user needs in mission design and development.

# NASA Applied Sciences Program: Applications Areas



## Emphasis in 4 Applications Areas



Health &  
Air Quality



Water  
Resources



Disasters

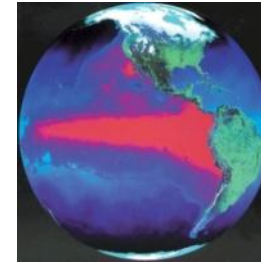


Ecological  
Forecasting

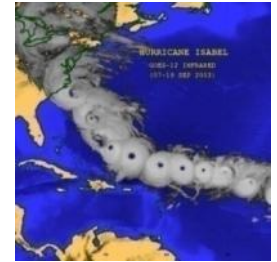
## *Support opportunities in 5 additional areas*



Agriculture



Climate



Weather



Energy



Oceans



- Formulation
- Implementation
- Primary Ops
- Extended Ops

# NASA Earth Science Missions

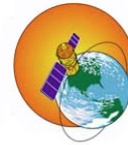


# Current NASA Missions Providing Data Related to Energy Sector Needs

Parameter Type	Satellite Missions/Instruments (Parameter)
<b>Solar Resources</b>	Solar Radiation and Climate Experiment (SORCE) STPSat-3 Total Solar Irradiance Calibration Transfer Experiment (TCTE) (non-NASA) (extraterrestrial solar irradiance)
	Aqua/Terra/NPP Cloud and Earth Radiant Energy System (CERES) (surface solar fluxes including direct and diffuse)
	DISCOVER NISTAR (surface solar flux) (products not available yet)
<b>Meteorological Parameters</b>	CALIPSO, CloudSat, GPM/GMI and DPR, Terra/Aqua/MODIS, Terra MISR, Aqua AIRS, Aura OMI, Suomi NPP VIIRS, DISCOVER/NISTAR and EPIC (cloud water and other cloud information)
	GPM/GMI and DPR, CloudSat (precipitation)
	Aqua AIRS/AMSU/HSB, Aura HIRDLS (atmospheric temperature)
<b>Atmospheric Composition</b>	Terra/Aqua/MODIS, Aqua AIRS, Aura MLS, Suomi NPP CRIS, GPM GMI, Joasn-2 (water vapor)
	CALIPSO, Terra/Aqua/MODIS, Terra MISR, Suomi NPP VIIRS, Aura OMI, DISCOVER/EPIC (aerosols)
	Aura OMI, Aura MLS, Aura TES, Aura HIRDLS, Aqua AIRS, OCO-2, DISCOVER/EPIC (ozone, gases)
<b>Land Parameters</b>	Shuttle Radar Topography Mission (SRTM, flown in 2000) (elevation/topography)
	Terra/Aqua/MODIS, Terra MISR, Terra ASTER, Suomi NPP VIIRS, Aura OMI DISCOVER/EPIC, Landsat (surface reflectance, albedo)

# POWER Overview

- **Objectives:** Improve the Nation's public/private capability for integrating environmental data from NASA research to support increased renewable energy development, energy efficiency and agricultural modeling.
- **Goals:** Through partnerships, derive/validate/provide parameters relevant to industry needs, link to decision support, and transition capabilities when possible.
- **Website:**  
<http://power.larc.nasa.gov>



Prediction  
Of  
Worldwide  
Energy  
Resource

Surface meteorology and Solar Energy (SSE-release 6.0) :  
A renewable energy resource web site sponsored by NASA's Applied Sciences  
Program in the Science Mission Directorate, [Applied Sciences Program](#)

Earth Science for Society: Accelerating the realization of economic and societal  
benefits from Earth science, information, and technology

Home Renewable Energy Parameters Sustainable Buildings Parameters Agroclimatology Parameters

Access Data

- SSE-Renewable Energy
- Sustainable Buildings
- Agroclimatology

Documentation

- About the POWER Project
- About Renewable Energy
- About Sustainable Buildings
- About Agroclimatology
- Global Geometry/Resolution

Processing, archiving, and distributing solar insolation and meteorological parameters for:

- SSE-RENEWABLE ENERGY:** Satellite and modeled derived data supporting Renewable Energy Technologies (RET's).
  - Over 200 satellite-derived meteorology and solar energy parameters
  - Monthly averaged parameters for the period July 1, 1983 through June 30, 2005
  - Daily averaged solar and meteorological data over the time period July 1983 - June 2005
  - Global coverage on a 1° latitude by 1° longitude grid
  - Data for the RETScreen® International Clean Energy Project Analysis Software

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Leading Clean Energy Innovation

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NREL's resource assessment and forecasting research supports the U.S. Department of Energy's Solar Energy Technologies

ASHRAE Shaping The Built Environ

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The David & Lucile Packard Foundation innovative, healthy and comfortable, and

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RETScreen Software Suite - Download Free

RETScreen is a Clean Energy Management Software system for energy efficiency, renewable energy and cogeneration project feasibility analysis as well as ongoing energy performance analysis.

Click here to download RETScreen Suite

Downloading and running RETScreen Software Suite on your computer will install two separate programs, RETScreen 4 and RETScreen Plus, described below.

RETScreen 4 is an Excel-based clean energy project analysis software tool that helps decision makers quickly and inexpensively determine the technical and financial viability of potential clean energy projects.

RETScreen Plus is a Windows-based energy management software tool that allows project owners to easily verify the ongoing energy performance of their facilities.

RETScreen Online Training - Free Webcasts

Introduction to Clean Energy Project Analysis

Energy Efficiency Project Analysis

Heating & Cooling Project Analysis

Power Project Analysis

Cogeneration Project Analysis

Energy Performance Analysis (slides only)

Newsletters

449537 users in 222 countries

Repowering an Existing Hydropower Station in Nigeria

City of Toronto Green Building Standards Specify RETScreen

Climate Change Mitigation Empowered by RETScreen

Weston Foods Attributes Significant Gas Savings to RETScreen Plus

More...

Managed by CanmetENERGY

NASA reep UNEP GEF

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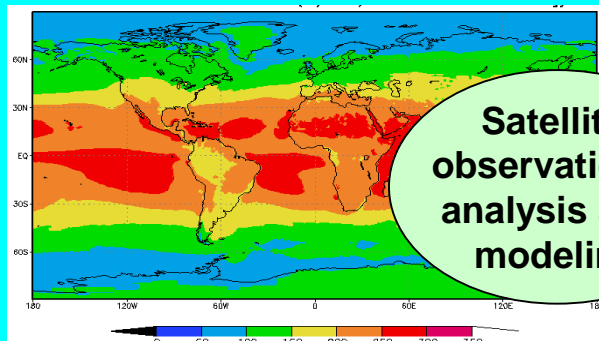
Important Notices



# POWER Approach: Research to Decisions



NASA Earth-Sun Satellite Analysis and Modeling Projects:  
(ISCCP, GEWEX SRB, CERES FLASHFlux, GMAO GEOS)



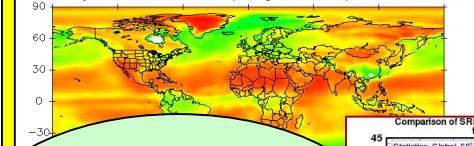
Surface Solar Irradiance ( $\text{W m}^{-2}$ )

Satellite observations, analysis and modeling

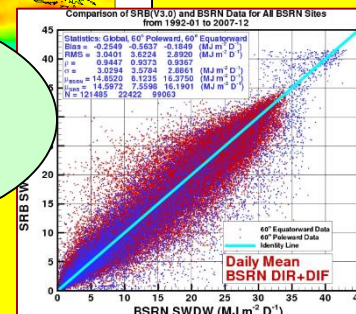
## POWER/SSE Project

Solar and meteorological parameters in specialized units

April Radiation on Equator-pointed tilted surfaces (Perez/Erbs et al. July 1983 – June 1993 / Angle of tilt equals latitude



Adaptation and validation of parameters



## RETScreen®



~ 450,000 Global Users

Decision Support System design and planning tool

Data Accessibility through Web Interface

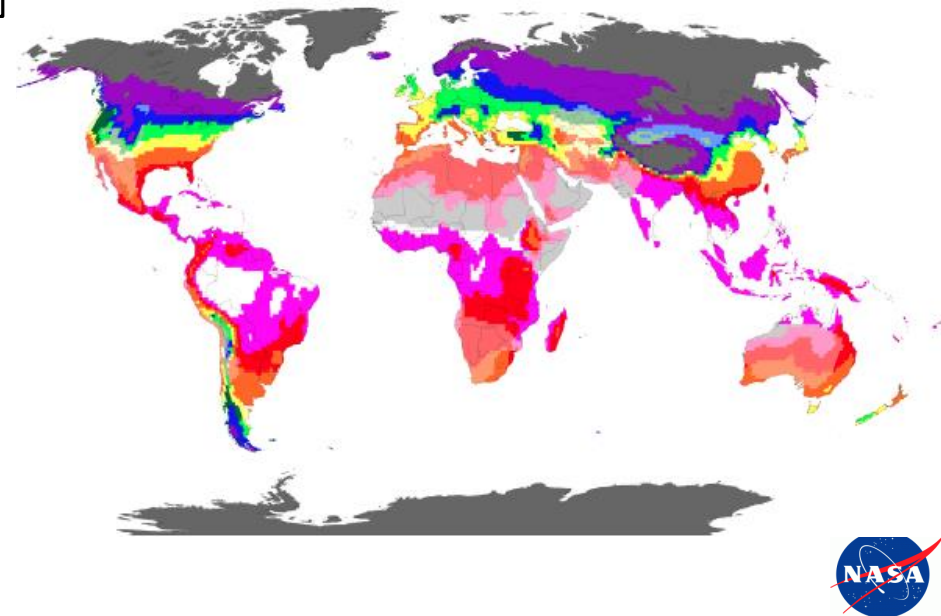
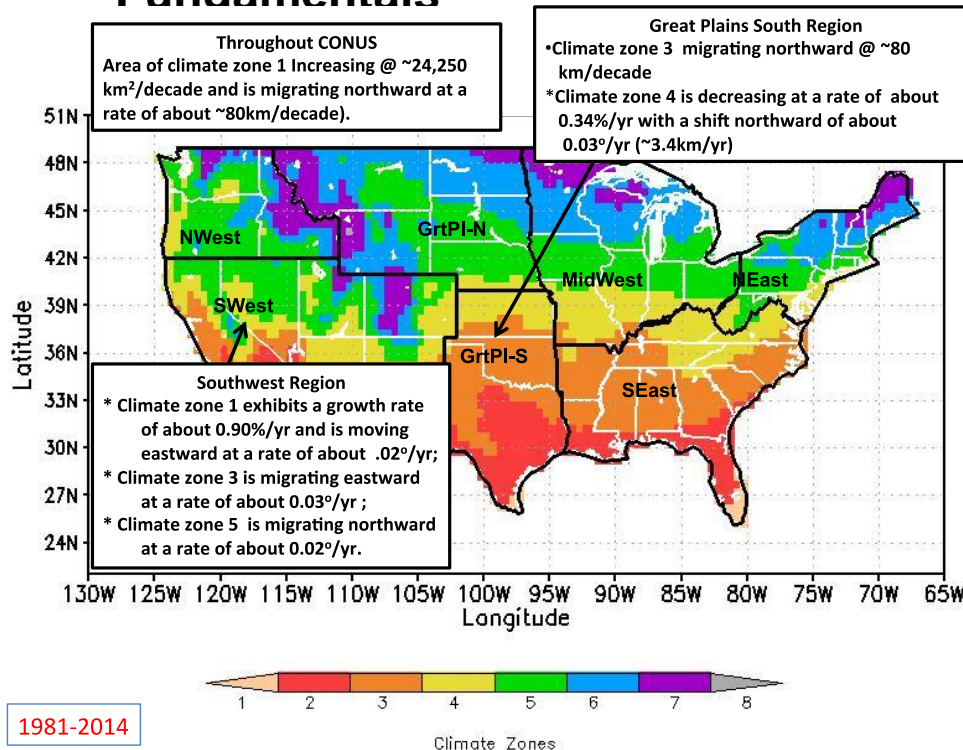
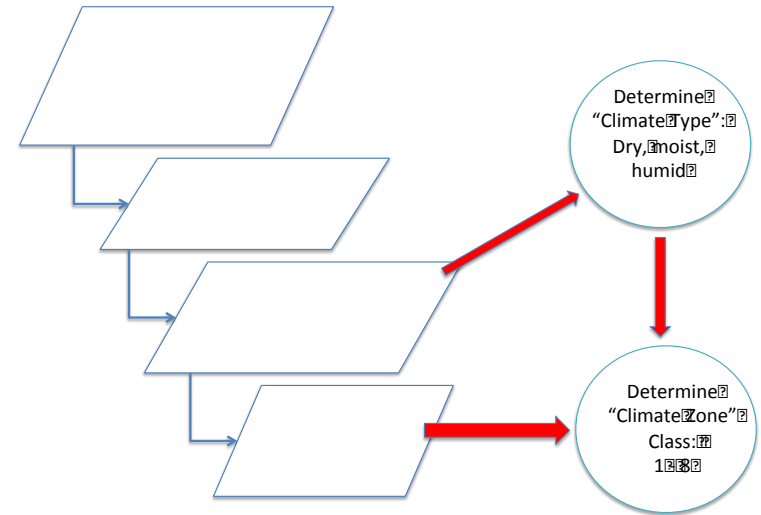
## POWER/SSE Datasets and

200+ Parameters (most on-the-fly)

(~15,000 unique users, ~ 1,200,000 hits and 230,000 data downloads per month)

# POWER and ASHRAE Collaboration: Assessing Building Climate Zone Changes

- Collaborated with ASHRAE to provide/assess Building Climate Zones from NASA reanalysis (GEOS-4 and MERRA)
- Provided to ASHRAE and it was included ASHRAE Handbook of Fundamentals





# Energy Initiatives



# Summary and Conclusions

- NASA has considerable investments in satellite measurements and analysis of those products for various earth science data products
- NASA also has an extensive modeling and assimilation capability comprising both long-term analysis, short-term, and climate forecasts
- Many of those data products have been useful in an Energy context
- What are the evolving needs of energy sector? What types and sorts of data are needed? What role can NASA play?